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54    Title:                    Overcurrent Protection for a Link Converter or  
                                  Self-commutated Inverter

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Claims

1. Overcurrent protection for a link converter with smoothing capacity in the link or self-commutated inverter with input side smoothing capacity and a disconnectable semi-conductor arrangement, characterized in that the disconnectable semi-conductor arrangement (T, D) is serially connected to the smoothing capacitor (Cd).
2. Overcurrent protection according to Claim 1, characterized in that the disconnectable semi-conductor arrangement consists of the parallel connection of a transistor (T) and a diode (D).

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Overcurrent Protection for a Link Converter  
or Self-commutated Inverter

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The invention relates to an overcurrent protection for a link converter or self-commutated inverter in accordance with the generic term of Claim 1.

In the case of link converters or self-commutated inverters the smoothing capacitor arranged in the link or parallel to the direct current voltage terminals of the inverter discharges in the case of conduction through or a short circuit at the output of the inverter in the manner of a surge current via the valves of the inverter. So that the valves are not destroyed by this, in known arrangements the maximum value of the current is limited by a protective reactor and the surge current in the case of a commutation failure of an additional thyristor (short circuiter thyristor) is absorbed, said thyristor being arranged at the input of the inverter or in the link and relieving the valves.

The surge currents occurring in the case of these known arrangements stress the capacitors, in particular the voltage feeds in considerable measure, as a result of which both the capacity and also the life time of the capacitors is reduced.

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In addition a special thyristor is necessary as a short circuiter thyristor, which must guide the high surge current. Additionally switches or overcurrent protectors are required which interrupt the supply of energy from the network.

From "Wissenschaftlichen Berichten" AEG-TELEFUNKEN 50 (1977), Heft 2/2, Seite 46 [„Scientific Reports“ AEG-TELEFUNKEN 50 (1977), Issue 2/2, Page 46] an overcurrent protection for a self-commutated inverter with thyristors is known, in which case a power transistor is arranged between the smoothing capacity and the inverter.

If for some reason a valve of the inverter can no longer erase or if it receives a missing pulse, the inverter conducts through, wherein the smoothing capacitor would discharge in the manner of a surge current over the inverter. In this case the transistor can be momentarily disconnected, so that an overcurrent is avoided, because during the turn off time of the transistor the current could not appreciably increase.

In the case of this known overcurrent protection neither the inverter valves nor the smoothing capacitors are loaded by surge currents. In the case of a commutation failure neither the overcurrent protectors nor high speed switches respond, so that service interruptions are avoided.

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It is the object of the present invention, proceeding from such an overcurrent protection while keeping the last mentioned advantages, to specify an overcurrent protection for a link converter or self-commutated inverter, in which case the semiconductor switch is not traversed by load current and nevertheless exercises the same protective capacity.

This task is solved in accordance with the invention by an overcurrent protection which is characterized by the fact that the disconnectable semiconductor arrangement is serially connected to the smoothing capacitor.

The inventive overcurrent protection guarantees that, in the case of a commutation failure of the inverter or converter, neither the overcurrent protectors nor high speed switches respond and the smoothing capacitors are not stressed in the manner of a surge current. Additionally it is guaranteed that the disconnectable semiconductor arrangement provided for overcurrent protection is not traversed by load current but rather only by superimposed alternating current, i.e. from capacitor current.

Since the inverter current on the basis of the smoothing reactor in the link after the responding of the overcurrent protection only slowly rises, the inverter can be disconnected without further expenditure by means of its existing erasing facilities. After that the inverter is immediately ready for operation again without further actions.

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The advantages of this protective equipment become all the more apparent, the greater the energy stored in the smoothing capacitor becomes in relation to the nominal power of a converter. This is for example the case with converters which are supplied from single-phase networks of lower frequency (e.g. 16 2/3-single-phase railroad networks).

The invention is to be explained more closely with the help of an exemplary embodiment shown in the drawing.

The self-commutated converter shown in the drawing consists of a two-phase or multi-phase rectifier GR, which is connected to a three-phase network, a link with direct-current link reactor  $L_d$  and smoothing capacity  $C_d$  as well as an inverter WR in three-phase bridge connection with six bridge arms.

In accordance with the invention a disconnectable semiconductor arrangement T, D is arranged in series to the smoothing capacitor  $C_d$ , said semiconductor arrangement consisting of a transistor T and a parallel connected diode D.

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As can be easily seen from the drawing, in normal operation the disconnectable semiconductor arrangement is not traversed by the load current but rather only from the capacitor current. If one of the thyristors is not able to erase or receives a missed pulse, the transistor T kept in a conductive state in normal operation is momentarily switched off, so that an overcurrent is avoided. Only during the turn off time of the transistor T is there a brief rise in the current, which however cannot lead to an endangerment of the inverter thyristors and of the smoothing capacitor  $C_d$ .